

XV. *Some Experiments on Substances resisting Putrefaction*; by John Pringle M. D.
F. R. S.

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here printed with Additions.

THO' an Inquiry into the Manner how Bodies are resolved by Putrefaction, with the means of accelerating or preventing that Process, has been reckoned not only curious, but useful (*a*), yet we find it little prosecuted in an experimental way: Nor is it to be wonder'd at, considering how offensive such Operations are: Wherefore, as I have been led to make some Experiments and Remarks on this Subject, from the Accident of having had an uncommon Number of putrid Distempers under my Care in the Hospitals of the Army, I shall venture to lay before the *Society* what I have found somewhat different from the common Opinion, as well as some Facts, which, as far as I know, have not been mention'd before.

I. Finding it a received Notion, that Bodies by Putrefaction became highly alcaline, I made the following Experiments, to inquire how far this was true in Fact.

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(*a*) Lord Bacon calls, "the inducing or accelerating Putrefaction" a Subject of very universal Inquiry;" and says, "that it is of excellent Use to inquire into the means of preventing or staying Putrefaction; which makes a great Part of Physick and Surgery." See *Nat. Hist. Cent.* IV.

The *Serum* of human Blood putrified, made, with a Solution of Sublimate, first a turbid Mixture, and afterwards a Precipitation. This is one of the Tests of an *Alkali*, but scarce to be admitted here; since the same thing was done with recent Urine (of a Person in Health), which is never accounted alkaline. The same *Serum* did not tinge the Syrup of Violets green; and made no Effervescence when the Spirit of Vitriol was poured upon it. I made the Experiment twice upon Portions of different *Serum*, both highly putrid; and once on Water, in which corrupted Flesh had been some time infused; and the most I could find was, that, having given the Syrup previously a small reddish Cast with an Acid, this Colour was rendered fainter, but not destroyed by the putrid Humours; and as to the Effervescence, having dropped the Spirit of Vitriol into these Liquors unmixed, and also diluted with Water, the Mixture was quiet, and only a few Air-bubbles appeared on shaking the Glasses. Upon the whole, tho' there were some Marks of a latent *Alkali* in the putrid *Serum*, they were so very faint, that one Drop of Spirit of Hartshorn in a Quantity of Water equal to that of the putrid Liquors, shewed more of an *Alkali* than twenty Drops of any of the other.

2. It has been a Maxim, that all animal Substances, after Putrefaction, being distill'd, send forth a great Quantity of volatile Salt in the first Water; but Mr. *Boyle* found that this held good only in Urine; and that in the Distillation of the *Serum* of human Blood putrefied, the Liquor which first came over had little Strength, either as to its Smell or Taste,

Taste, and did not at first effervesce with an Acid. And here it may be observed, that the Chemists have generally applied those Properties they discovered in Urine, to all the Humours indifferently; whereas, in Fact, there is a great Diversity. For some animal Substances, such as Urine and Bile, *soon* putrefy; the *Saliva* and the White of an Egg *slowly*. Yet those that soonest corrupt do not always arrive at the highest Degree of Putrefaction. Thus the Bile is soon corruptible, but the Rankness of it is not to be compared to that of Flesh; and the White of an Egg is not only much less disposed to putrefy than the Yolk, but, when corrupted, yields a different and less offensive Smell. And it seems particular to stale Urine to contain an alkaline Salt, which, without Distillation, makes a strong Effervescence with Acids: Whereas most other animal Humours putrefied, tho' of a more intolerable *Fætor*, yet contain less volatile Salt, less extricable, and not effervescing with Acids. But what makes the Difference between stale Urine and other putrid Substances still more specific, is, its Inoffensiveness with regard to Health; whilst the Steams of most other corrupted Bodies are often the Cause of putrid and malignant Diseases.

Now, upon finding in Urine a much greater Quantity of volatile Salt, and that more easily separable than in any other Humour, and that stale Urine is the least noxious of putrid animal Substances, so far then from dreading the volatile *Alkali* as the deleterious

* Nat. Hist. of Human Blood, Vol. IV. p. 178. fol.

leterious Part of corrupted Bodies, from this Instance we may rather infer it to be a sort of Corrector of Putrefaction.

3. Daily Experience shews how harmless the Volatiles are, both when smelled to, or taken in Substance; but still there remains a Prejudice, as if these Salts, being the Produce of Corruption, should therefore hasten Putrefaction; not only in Distempers where these Salts are unwarily taken, but also in Experiments out of the Body.

Now, as to the Effects arising from the internal Use of them, little can be said, unless the kind of Disease was precisely stated. For, supposing they were by their Nature disposed to promote Putrefaction; yet if that is already begun, from a Languor of Circulation, and Obstruction, then may the Volatiles, by their stimulating and aperient Quality be the means of stopping its Progress: And, on the other hand, tho' they were really antiseptic, yet if the Humours are disposed to corrupt from Excess of Heat or Motion, these very Salts, by adding to the Cause, may augment the Disease. So that, upon the whole, it will be the fairest Criterion of the Nature of these Volatiles to enquire, whether out of the Body they accelerate or retard Putrefaction.

In order to decide this Question, I have made repeated Experiments of joining both the Spirit and Salt of Hartshorn to various animal Substances; and have constantly found, that, so far from promoting Putrefaction, they have evidently hinder'd it; and that with a Power proportioned to their Quantity. The Trials have been made with the *Serum* of the Blood, and also with the *Crassamentum*, after it had

been dried by keeping. I once separated the thick inflammatory Crust of pleuritic Blood from the rest of the Mass; and, dividing it, I put one Portion into distill'd Vinegar, the other into Spirit of Hartshorn; and after keeping the Infusions above a Month in the middle of Summer, I found the Piece which lay in alkaline Spirit as sound as that in the Acid.

Another time I put in one Phial about an Ounce and a half of an equal Mixture of Ox's Gall and Water, with 100 Drops of Spirit of Hartshorn; and in another as much of the Gall and Water without any Spirit. The Phials, being corked, were set by a Fire, so as to receive about the Degree of animal Heat; whereby, in less than two Days, the Mixture without the Spirit became putrid, but the other was not only then, but after two Days longer untainted.

I afterwards infused two Drachms of the Lean of Beef with two Ounces of Water and half a Drachm of Salt of Hartshorn. Another Phial contained as much Flesh and Water with a double Quantity of Sea-Salt: In a third was the Flesh and Water only to serve by way of Index. These Phials were placed on a Lamp-Furnace, in a Heat varying between 94 and 104¹/₂ Degrees of *Fahrenheit's* Scale. About 18 Hours after Infusion, the Contents of that Phial which served as an Index, were rank; and in a few Hours more that with the Sea-Salt was also putrid; but the Flesh with the volatile Alkali was sound, and continued so after standing 24 Hours longer, in the same Degree of Heat: And that the Smell of the Hart's-horn might occasion no Deception, the Piece of Flesh was washed from the Salt, and still smelled sweet.

About the same time I took three Pieces of fresh Beef, of the same Weight as above; and laying two

of them in Gallypots, I cover'd one with Saw-dust, and the other with Bran : But the third Piece being strew'd with Salt of Hartshorn powder'd I put into a four Ounce Phial which had a glass Stopper. They were all three placed in the Outside of a Window expos'd to the Sun; and the Weather being warm, on the third Day the Flesh in the Gallypots began to smell; on the fourth were putrid. Next Day the Phial was examined; when the Flesh was washed from the Salt, and found quite sweet. It was then dry'd and salted again with Hartshorn; and having stood in the House some Weeks longer in sultry Weather, it was look'd at a second time, and observed to be as sound as before; neither was the Substance at all dissolved, but was of such a Consistence as might be expected from common Brine*. And lest it might be suspected, that the Flesh in the Gallypots, by being more expos'd to the Air than that in the Phial, became sooner putrid, I have since inclos'd Flesh in Phials, as that with the Hartshorn and found the Confinement rather hasten the Putrefaction.

Now, by these and many other Experiments of the kind, finding volatile alkaline Salts not only do not dispose animal Substances to Putrefaction out of the Body, but even prevent it, and that more powerfully than common Sea-Salt, we may presume that the same taken by way of Medicine, will, *cæteris paribus*, prove antiseptic; at least we cannot justly suppose them Corrupters of the Humours more than fermented Spirits or Sea-Salt; which

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* The same Piece has been since kept dry a Twelvemonth, and is still untainted, and as firm as at first.

taken in immoderate Quantities may raise a Fever, and thereby accidentally be the Occasion of Corruption.

4. I have likewise made several Experiments with the fixed alkaline Salts which have no less antiseptic Power than the volatile. The Trials were made both with the Lye of Tartar and Salt of Wormwood. But here we must not confound a disagreeable Smell of such Mixtures with one that is really putrid ; nor the Power those Lixivials have of dissolving animal Substances with Putrefaction.

5. From these Experiments it was natural to conclude, since Acids by themselves were amongst the most powerful Antiseptics, and the alkaline Salts were likewise of that Class, that the Mixtures of the two to Saturation would resist Putrefaction little less than the Acid alone. But in the Trials I have made upon Flesh with a *Spiritus Mindereri* composed of Vinegar saturated with Salt of Hartshorn, and also with the Juice of Lemons saturated with the Salt of Wormwood, I found the antiseptic Virtue considerably less than when either the Acids or *Alkali's* were used singly.

6. As for the comparative Virtues of these Salts upon Flesh, I found half an Ounce of Lemon-juice saturated with a Scruple of the Salt of Wormwood resisted Putrefaction nearly as much as fifteen Grains of Nitre ; but, when the Trial was made with Ox's Gall, two Drachms of this Mixture were more antiseptic than a Scruple of that Salt. Again, Nitre compar'd with the dry neutral Salts, Weight for Weight, is more antiseptic than any in preserving Flesh I have yet tried. Crude *Sal ammoniac.* came next to it, and even exceeded it in the Experiment with Ox's Gall. After these the *Sal diureticus, Tartarus solubilis,*
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and *Tartarus vitriolatus*, seemed to have nearly the same Power.

I have mixed Vinegar with a large Quantity both of Chalk and Crabs-eyes, in order to neutralize it; but, tho' seemingly saturated by the Effervescence ceasing, it still retain'd an Acidity, and was found much more antiseptic than Lemon-juice neutraliz'd with the Salt of Wormwood; tho' this last Acid be considerably stronger than Vinegar.

7. Thus far have we consider'd the common neutral Salts; which, however powerful in resisting Putrefaction, are inferior to some resinous Substances, and even some Vegetables which I have tried. Thus Myrrh, in a watry *Menstruum* was found at least twelve times more antiseptic than Sea Salt. Two Grains of Camphire mixed with Water preserved Flesh better than sixty Grains of that Salt: And I imagine, could the Camphire be kept from flying off, or concreting to the Sides of the Phial, that half a Grain, or even less, would have sufficed. An Infusion of a few Grains of *Virginian* Snake root in Powder exceeded twelve times its Weight of Sea-Salt. Chamomile-Flowers have nearly the same extraordinary Quality. The Jesuit's Bark has it also; and if I have not found it so strong as the two Substances last mention'd, I impute that in part to my not being able to extract its embalming Parts in plain Water.

Now Vegetables possessing this balsamic Quality are the more valuable, in that, being usually free of Acrimony, they may be taken in much greater Quantities than either Spirits, Acids, Resins, or even the neutral Salts. And as in the great Variety of Substances
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answering this Purpose, there may be also some offensive or useful Qualities annexed, it may not be amiss perhaps to review some Part of the *Materia medica* for this End.

I shall add, that, besides this extraordinary Power in preserving Bodies, I have discover'd in some of these Substances a sweetening or correcting Quality after Putrefaction had actually begun. But these Experiments I shall lay before the *Society* some other time; with a Table of the comparative Force of Salts, and some further Remarks on the same Subject.

N. B. *These Experiments will be continued in the next Number of these Transactions.*

XVI. *An attempt to explain an antient Greek inscription, ingraven upon a curious bronze cup with two handles, and published with a draught of the cup by Dr. Pococke, in his Description of the East, Vol. II. Part 2. pag. 207. By John Ward, Pr. Rhet. Gresh. and F. R. S.*

Read June 28. 1750. **T**HE diameter of the cup on the inside is about thirteen inches and a half, as near as I could take it from a copy of the inscription, which is placed round the upper side of the rim. A draught of which is hereunto annexed, reduced to about two thirds of the size (1); and
